

REMARKS

Claims 1-5 and 7-16 are pending in the above-identified patent application. Claims 1-5 have been amended and claims 7-16 have been added by way of the present amendment.

In the outstanding Office Action, the specification was objected to due to informalities; claims 1-6 were rejected under 35 U.S.C. 112, 2nd paragraph; claim 6 was rejected under 35 U.S.C. Section 102(e) as being anticipated by U.S. Patent No. 6,594,320 (Sayeed); claims 1-3 were rejected under 35 U.S.C. Section 103(a) as being unpatentable over U.S. Patent Publication No. 2003/0185147 (Taga et al.) in view of U.S. Patent No. 6,956,893 (Frank et al.); and claims 4 and 4 were indicated as allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph and to include all of the limitations of the base claims and any intervening claims. Reconsideration is respectfully requested.

Allowable Subject Matter

First, Applicant would like to thank Examiner Vuong for the early indication of allowable subject matter. In particular, claims 4 and 5 were indicated as allowable if rewritten to overcome the rejections under 35 U.S.C. 112, 2nd paragraph and to include all of the limitations of the base claims and any intervening claims. To that end, the rejections under 35 U.S.C. 112, 2nd paragraph have been overcome, as discussed below, and claim 4 has been rewritten in independent form. Therefore, it is respectfully submitted that claims 4 and 5, and claims dependent thereon, are in condition for allowance.

Amendments to the Specification

The specification was objected to due to informalities. The specification has been amended to clarify the invention. In particular, the abbreviation MMSE was amended to be interpreted as “Minimum Mean Square Error” to correct a typographical error that listed the abbreviation as “Minimum Mean Square Estimation.” In addition, the paragraph beginning on page 2, line 8 (i.e., after the title: SUMMARY OF INVENTION) to correct additional typographical errors. Support for the amendments is provided at least by the specification at

page 2, lines 16-19 and is a well known in the art as an algorithm for estimation. Therefore, it is respectfully submitted that the amendment raises no question of new matter.

35 U.S.C. Section 112 Rejections

Claims 1-6 were rejected under 35 U.S.C. 112, 2nd paragraph. Claims 1-5 have been amended to clarify the invention and claim 6 has been canceled by way of the present amendment. In particular, the claims have been amended to provide proper antecedent basis for the recited limitations.

In addition, claim 3 has been amended to further clarify the invention. In particular, claim 3 has been amended to recite:

~~wherein the said pilot subcarrier set S_p estimating CPE~~
~~further comprises taking the CPE estimate taken from after the~~
~~MMSE equalization and data detection as a first data decision and~~
~~fed back output providing decision feedback to and for further CPE~~
~~estimation to thereby further improve improving the CPE estimate~~
~~which proceeds for MMSE equalization and data detection.~~

Support for the amendment is provided at least on page 7, line 17 to page 8, line 2; and shown at least in **FIG. 1**. Therefore, it is respectfully submitted that the amendments raise no questions of new matter and that claims 1-5 are now definite.

35 U.S.C. Section 102 Rejections

Claim 6 was rejected under 35 U.S.C. Section 102(e) as anticipated by Sayed. Claim 6 has been canceled. Therefore, the rejection of claim 6 is moot.

35 U.S.C. Section 103 Rejections

Claims 1-3 were rejected under 35 U.S.C. Section 103(a) as being unpatentable over Taga et al. in view of Frank et al. Reconsideration is respectfully requested.

Claim 1 has been amended to clarify the invention. In particular, claim 1 has been amended to recite:

RF downconverting and analog-to-digital (A/D) converting
the OFDM to provide a baseband OFDM signal;
performing an FFT on the baseband OFDM signal;

estimating ICI plus noise from the a null subcarrier set S_N
 extracted from the FFT of the baseband OFDM signal; and
 estimating CPE from the a pilot subcarrier set S_P extracted
 from the FFT of the baseband OFDM signal; and
 applying the both said estimates in MMSE equalization and
 data detection of the a data subcarrier sample set S_D .

Support for the amendment is provide at least at page 3, line 11 to page 4, line 15; and shown at least in FIG. 1. Therefore, it is respectfully submitted that the amendment raises no questions of new matter.

Taga et al. discloses an apparatus for receiving an OFDM modulated signal.¹ In particular, Taga et al. discloses the OFDM receiving apparatus includes an Analog to Digital (A/D) converter **102**, a quadrature demodulator **103**, a Fast Fourier Transform (FFT) circuit **104**, a Common Phase Error (CPE) elimination circuit **105**, an equalizer **106**, an error correcting circuit **107**, an interference detector **109**, and a synchronous sequencer **110**.² Further, Taga et al. discloses the interference detector **109** detects the variance from a reference signal point of the pilot signal for each sub-carrier of the pilot signal and outputs the weighting coefficient to the CPE elimination circuit **105** as the receiving quality data based on the result of the variance detection.³

However, Taga et al. nowhere discloses, as amended claim 1 recites:

*estimating ICI plus noise from a null subcarrier set S_N
 extracted from the FFT of the baseband OFDM signal;
 estimating CPE from a pilot subcarrier set S_P extracted
 from the FFT of the baseband OFDM signal; and
 applying both said estimates in MMSE equalization and
 data detection of a data sample set S_D (emphasis added).*

That is, Taga et al. nowhere discloses “estimating ICI plus noise from a null subcarrier set S_N ” nor “applying both said estimates in MMSE equalization and data detection of a data sample set S_D ,” as recited in amended claim 1.

Further, claim 3 is dependent upon claim 1. Moreover, Taga et al. nowhere discloses, as amended claim 3 recites:

¹ Taga et al. at ABSTRACT.

² *Id.* at paragraph **[0023]**.

³ *Id.* at paragraph **[0030]**.

wherein the estimating CPE further comprises taking the CPE estimate after the MMSE equalization and data detection as a first data decision output providing decision feedback to and further improving the CPE estimate. (emphasis added).

That is, Taga et al. nowhere discloses “providing decision feedback to and further improving the CPE estimate.” Therefore, it is respectfully submitted that Taga et al. does not disclose the limitations of claims 1-3.

The outstanding Office Action also acknowledges deficiencies in Taga et al. and attempts to overcome these deficiencies by combining Taga et al. with Frank et al. However, Frank et al. cannot overcome all of the deficiencies of Taga et al., as will be discussed below.

Frank et al. discloses provides linear MMSE equalization with parallel interference cancellation for symbol determination in a forward link of a CDMA communication system which has a plurality of code channels in use.⁴ In particular, Frank et al. discloses a receiver 100 for MMSE equalization with parallel interference cancellation where a received signal is input into a linear feedforward equalizer (“LFE”) 105, which is preferably implemented as a minimum mean square error (MMSE) equalizer with the error being minimized *through adaptation of filter coefficients* in both LFE 105 and 145 (emphasis added).⁵

However, Frank et al. nowhere discloses, as amended claim 1 recites:

estimating ICI plus noise from a null subcarrier set S_N extracted from the FFT of the baseband OFDM signal;
estimating CPE from a pilot subcarrier set S_P extracted from the FFT of the baseband OFDM signal; and
applying both said estimates in MMSE equalization and data detection of a data sample set S_D (emphasis added).

That is, Frank et al. nowhere discloses “estimating ICI plus noise from a null subcarrier set S_N ” nor “applying both said estimates in MMSE equalization and data detection of a data sample set S_D ,” as recited in amended claim 1.

Further, claim 3 is dependent upon claim 1. Moreover, Frank et al. nowhere discloses, as amended claim 3 recites:

wherein the estimating CPE further comprises taking the CPE estimate after the MMSE equalization and data detection as a

⁴ Frank et al., at ABSTRACT.

⁵ *Id.* at column 3, lines 53-57.

first data decision output providing decision feedback to and further improving the CPE estimate. (emphasis added).

That is, Frank et al. nowhere discloses “providing decision feedback to and further improving the CPE estimate.” Thus, Frank et al. cannot overcome the deficiencies of Taga et al. Therefore, it is respectfully submitted that neither Taga et al. nor Frank et al., whether taken alone or in combination, disclose, suggest or make obvious the claimed invention and that claims 1-3 and patentably distinguish thereover.

New Claim

New claims 7-16 have been added to address additional features of the invention. In particular, new claims 9 and 11 recite:

wherein after providing the decision feedback to the CPE estimate, outputting a final data decision based on *performing the MMSE Equalization and data detection on: the ICI estimate, the data sample set S_D and the improved CPE estimate* (emphasis added)

Support for the new claims is provided at least on page 7, line 17 to page 8, line 2; and shown at least in **FIG. 1**. New claims 7, 8 and 10 found support in original claims 4 and 5. New claims 11-16 find support in equations 7, 8, 11, 12 and 13. Therefore, it is respectfully submitted that the new claim raise no questions of new matter.

At least for the reasons discussed above, it is respectfully submitted that neither Taga et al. nor Frank et al., whether taken alone or in combination, disclose, suggest or make obvious the claimed invention. In addition, neither of the above references disclose, as claims 9 and 11 recite: “performing the MMSE Equalization and data detection on: the ICI estimate, the data sample set S_D and the improved CPE estimate.” Therefore, new claim 7-16 also patentably distinguishes over both Taga et al. and Frank et al.

Conclusion

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to pass this application to issue.

If a fee is due with this response, please charge our Deposit Account No. 22-0185, under Order No. 27592-00182 from which the undersigned is authorized to draw.

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